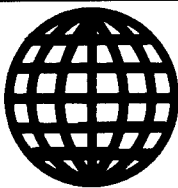


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# ***JPRS Report***

# **Science & Technology**

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# Science & Technology

## USSR: Chemistry

JPRS-UCH-90-002

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UDC 543.4:542.61:535.24:546.59

**Extraction-Photometric Determination of Gold (III) With Methylene Blue**

18410252A Tashkent UZBEKSKIY KHIMICHESKIY ZHURNAL in Russian No 3, May-Jun 89 (Manuscript received 23 Nov 88) pp 5-7

[Article by K. Rakhmatullayev, and A. Sh. Giyasov, Tashkent Polytechnical Institute imeni Abu Raykhan Berun]

[Abstract] In order to increase the selectivity and accuracy of the determination of gold (III), the authors studied the conditions of selective extraction of gold (III) in the presence of chloride ions and DMFA, plus its complex formation with methylene blue in the organic phase. The resultant method of extraction-photometric determination of gold was tested in the analysis of rocks, ores, and concentrates. A charge heated to 600-650 °C for 1.5 hours is placed in a conical 250 ml-flask; then, 30-60 ml of hydrochloric and nitric acids (3:1) is added and evaporated to moist salts. Next, 10-20 ml of the same acid mixture is added and once more evaporated to moist salts, after which 30-40 ml water is added and boiled 5-10 minutes. The solution is cooled and filtered in a 50- or 100-ml flask, after which the filtrate is diluted with water to the mark and the gold content determined from the aliquot. References: 4 Russian.

UDC 543.272.57

**Standard Method of Determining Sulfur Compounds in Natural Gas and Its Alternative**

18410252B Tashkent UZBEKSKIY KHIMICHESKIY ZHURNAL in Russian No 3, May-Jun 89 (Manuscript received 23 Nov 88) pp 8-11

[Article by Ye. F. Fedorov, G. P. Gorkovaya, K. M. Kazakov, and L. I. Koreshkova, Central Asian Scientific Research and Planning Institute of Natural Gas]

[Abstract] The results of an analysis of natural gas for hydrogen sulfide and mercaptans by the standard method described in GOST 22387.2-83 are largely dependent on the conditions under which the analysis is performed. The standard method, when applied to gas after purification, can yield results that vary widely. The quantities of mercaptans found depend on the season and time of day. An alternative is suggested: monitoring the content of the substances tested by determining their sum upon concentration from the gas in alkaline bottles. Figure 1.

UDC 631.895

**Mass Spectrometric Study of Gaseous Products of Decomposition of Urea With Humic Acids Present**

18410252C Tashkent UZBEKSKIY KHIMICHESKIY ZHURNAL in Russian No 3, May-Jun 89 (Manuscript received 23 Nov 88) pp 12-14

[Article by S. M. Tadzhiev, S. Tukhtayuv, Yu. A. Khamidov, and M. G. Khusankhadzhayev, Institute of Chemistry, Uzbek Academy of Sciences]

[Abstract] A mass spectrometric study was made of the influence of humic acids on the mechanism of the thermal decomposition of urea and the composition of the decomposition products. An IR spectroscopic study established that the separation of water from the humic acids occurs at 373 and 15 K, the breakdown of the aliphatic portion of the molecule occurs at 553, 15-603, and 15 K, and the transformation of the aromatic nucleus occurs at 723 and 15 K and higher. The gas phase of urea during low-temperature decomposition was found to consist of ammonia and carbon dioxide. Water vapor (in small quantities) is present in the gas phase at low temperatures due to decomposition of the urea (the IR spectra of the solid phase of urea containing humate indicate the presence of allophanamide. Figures 2; References 8: Russian.

UDC 546.48/49/24.03

**Current Status of Methods for Determining Impurity Composition of Cadmium-Mercury Telluride and Its Components**

18410264A Moscow VYSOKOCHISTYYE VESHCHESTVA in Russian No 3 May-Jun 89 (Manuscript received 4 Jul 88) pp 21-31

[Article by R. A. Kuznetsov, A. V. Gorshkov, and M. M. Usmanova, Institute of Nuclear Physics, Uzbek Academy of Sciences, Ulugbek]

[Abstract] The properties of cadmium-mercury telluride, both electrophysical and photoelectric, largely depend on the defect impurity structure of the crystals. This article formulates requirements for methods of analysis of  $Cd_xHg_{1-x}Te$  and its components. Methods of analysis and areas of their application are compared. References 69: 35 Russian, 34 Western.

UDC 621.315.592:546.28

**Influence of Isovalent C, Ge, and Sn Impurities on Structure and Properties of Amorphous Silicon**

18410264B Moscow VYSOKOCHISTYYE VESHCHESTVA in Russian No 3, May-Jun 89 (Manuscript received 4 Jul 88) pp 32-36

[Article by A. F. Khokhlov, D. A. Pavlov, R. V. Kudryavtseva, and A. V. Yershov, Gorkiy Research Physical Technical Institute, Gorkiy State University imeni M. I. Lobachevskiy]

[Abstract] Layers of amorphous silicon produced by magnetron atomization by direct current in an atmosphere of argon are investigated. The introduction of isovalent impurities was performed by ion implantation or atomization of compound targets. The composition of the layers obtained was determined by electron Auger spectroscopy and x-ray fluorescent analysis. Introduction of Ge atoms has little influence on close-order structures of  $\alpha$ -Si. Doping with tin increases the radius of the coordination spheres, while carbon decreases this radius. At 20 at. percent carbon, the

third peak of the radial electron density distribution function disappears completely. When isovalent impurities are added by ion implantation, some differences are observed in the changes in close-order structure. The changes in structure upon isovalent doping result from differences in the covalent radii of the impurity atoms and silicon atoms and are largely determined by the doping method. Isovalent impurities can be used to control the properties of the silicon. Figures 6; References 6: 5 Russian, 1 Western.

UDC 539.22

### Measurement of Electron Scattering Characteristics in Metals by Ultrasound

18410264C Moscow VYSOKOCHISTYYE VESHCHESTVA in Russian No 3, May-Jun 89 (Manuscript received 4 Jan 88) pp 42-45

[Article by A. B. Rinkevich, Ya. G. Smorodinskiy, and R. Sh. Nasyrov, Institute of Metal Physics, USSR Academy of Sciences, Urals Science Center, Sverdlovsk]

[Abstract] The possibility is studied of using certain physical phenomena occurring upon propagation of ultrasonic waves through metals in a magnetic field to certify the quality of single crystals. If elastic waves propagate along an axis in a crystal parallel to a magnetic field and if the displacement of electrons in the cyclotron period corresponds with the ultrasound wave length, Doppler-shift acoustical cyclotron resonance occurs and is observed as sharp maxima in the absorption factor. The relative half-width of these maxima can be expressed simply through the mean free path length of the electrons. Experimental results are presented from measurement of these characteristics in tungsten and molybdenum. Figures 3; References 7: 5 Russian, 2 Western.

UDC 547.912:543.54

### Analysis of C<sub>1</sub>-C<sub>5</sub> Hydrocarbons Dissolved in Petroleum

18410271E Moscow KHIMIYA I TEKHOLOGIYA TOPLIV I MASEL in Russian No 8, Aug 89 pp 40-41

[Article by L. S. Blinova, S. G. Kushnikova, and Ya. A. Belikhmayer, Tomsk Polytechnical Institute]

[Text] A method is developed that allows a standard chromatographic column used for determination of hydrocarbon gases dissolved in petroleum and condensates to be used to determine the content of C<sub>1</sub>-C<sub>5</sub> hydrocarbons dissolved in petroleum. The error is reduced by adding a fixed quantity of a standard additive—in this case n-pentane—to the oil to be analyzed. The process of the analysis is described and illustrated. The absolute error in

determining the hydrocarbons varied from 0.01 to 0.3 percent. The method does not involve the loss of light gases typical of the standard method and allows the volume of the sample to be reduced while retaining the same accuracy of determination and releasing equipment for other uses. References 3: Russian.

UDC 536.7

### Kinetic Determinant of Thermomechanical System

18410275A Moscow ZHURNAL FIZICHESKOY KHIMII in Russian Vol 43 No 8 Aug 89 (Manuscript received 12 May 88) pp 2047-50

[Article by V. Ya. Baskakov, V. B. Baskakova, and A. A. Khrustaleva]

[Abstract] The stability determinant D represents the full thermodynamic stability of a phase. This article introduces the kinetic determinant D<sub>kin</sub> of a thermomechanical system and shows the close interrelationship between the stability determinant and the kinetic determinant. This is reflected in the fact that B and D<sub>kin</sub>/D can be calculated by different equations depending on the experimental data available. The close relationship of D and D<sub>kin</sub> allows broader utilization of experimental material in the search for new relationships and allows the number of experiments required for determination of the necessary quantities with the desired accuracy to be reduced. Several equations are derived that relate the values of D and D<sub>kin</sub>. The variation of the parameters D and D<sub>kin</sub> on subcritical isobars for water as a function of temperature is determined. Figures 2; References: 4 Russian.

UDC 536.423.15

### Thermodynamic Properties of Iron Alloys With Manganese

18410275B Moscow ZHURNAL FIZICHESKOY KHIMII in Russian Vol 43 No 8, Aug 89 (Manuscript received 12 May 88) pp 2051-56

[Article by A. I. Zaytsev, M. A. Zemchenko, and B. M. Mogutnov, Central Scientific Research Institute of Ferrous Metallurgy imeni I. P. Bardin, Moscow]

[Abstract] High-temperature mass spectrometry is used to measure the vapor pressure of manganese over Fe-Mn alloys at 967-1410 K in the range of 0-40.5 atomic percent Mn. All measurements were performed on alloys in the area of solid Fe-Mn  $\gamma$  solutions, except for measurements of manganese vapor pressure at 967-1102 K over an alloy with x<sub>Mn</sub>=0.0096, which is in the range of solid solutions of manganese in bcc iron. The thermodynamic functions agree well with earlier data and the state diagram of Fe-Mn and are recommended for thermodynamic computations. Figures 4; References 23: 6 Russian, 17 Western.

UDC 541.13;546.92;546.97

**Change in Adsorption-Catalytic Properties of Platinum-Rhodium Catalyst Upon Preliminary Treatment**

18410275C Moscow *ZHURNAL FIZICHESKOY KHIMII in Russian* Vol 43 No 8, Aug 89 (Manuscript received 3 Mar 88) pp 2057-62

[Article by T. M. Grishina, and Ye. V. Meshcheryakova, Moscow State University imeni M. V. Lomonosov, Department of Chemistry]

[Abstract] A comparative study is presented of the adsorption and catalytic properties of freshly prepared electroprecipitated catalysts with the composition Pt-15 atomic percent Rh, both freshly prepared and after various types of treatment. Stabilization causes a decrease in the surface area of the catalyst and changes its energy characteristics with respect to hydrogen. The catalytic activity of the electrodes is determined by the method of preliminary processing. The variations in catalytic activity observed as functions of preliminary processing conditions are probably basically related to changes in the structure of the catalyst. Figures 2; References 13: 9 Russian, 4 Western.

UDC 546.741.4.131:/539.27+539.193+539.194

**Structure of Uranium Tetrachloride Molecule**

18410275D Moscow *ZHURNAL FIZICHESKOY KHIMII in Russian* Vol 43 No 8, Aug 89 (Manuscript received 16 Jan 89) pp 2247-49

[Article by V. I. Bazhanov, S. A. Komarov, and Yu. S. Yezhov, Institute of High Temperatures, USSR Academy of Sciences, Moscow]

[Abstract] The experimental diffraction picture of the  $UCl_4$  molecule was interpreted on the basis of prior experimental data and new values of the moduli and phases of atomic scattering amplitudes for uranium. The use of the new atomic scattering amplitude functions resulted in an increase in the calculated values of  $R_{ij}$  and  $L_{ij}$ , with little change in valent angles. The  $UCl_4$  molecule has the configuration of a distorted tetrahedron with  $C_{2v}$  symmetry with equilibrium configuration parameters  $R(UCl)=2.53(1)A$ ,  $\Delta=0.13(3)A$ ,  $\alpha=90(10)^\circ$ ,  $\beta=100(10)^\circ$ . Figure 1; References 10: 6 Russian, 4 Western.

UDC 541.18

**Surface Forces and Their Role in Disperse Systems**

18410224A Moscow *ZHURNAL VSESOYUZNOGO KHIMICHESKOGO OBSHCHESTVA in Russian* Vol 34 No 2, Mar-Apr 89 pp 7-14

[Article by B. V. Deryagin, Corresponding Member, USSR Academy of Sciences, and V. Churayev, Professor, Institute of Physical Chemistry, USSR Academy of Sciences]

[Abstract] Long-acting surface forces play the same role in dispersed systems that intermolecular interaction forces play in condensed liquids and solids. Surface forces determine the distance between particles, their orientation, and the number and strength of the bonds formed among them. Surface or near-surface forces in dissimilar phases are of two kinds: forces acting on molecules and ions near the interface between phases and forces that arise when the layer of liquid or gaseous phase separating two other phases becomes thin and the areas in which the first forces act begin to overlap. Studies of these two types of forces in the Soviet and American literature are described. Many unsolved problems remain. Future progress will be determined by the development of computer technology and statistical methods for investigation of the properties of liquids and solutions in thin layers. Development of new precision instruments and methods measuring forces on model bodies with distances between them of less than 5 nm is also required in order to obtain the experimental results needed for further development of the theory. Figures 7; References 45: 29 Russian, 16 Western.

UDC 541.18.049:576.8.553.21

**Heterocoagulation of Microorganisms With Disperse Systems**

18410224B Moscow *ZHURNAL VSESOYUZNOGO KHIMICHESKOGO OBSHCHESTVA in Russian* Vol 34 No 2, Mar-Apr 89 pp 15-22

[Article by F. B. Ovcharenko, Z. R. Ulberg, and V. Pertsov, Professors, Institute of Colloid Chemistry and Water Chemistry, Moscow State University imeni M. V. Lomonosov]

[Abstract] Studies have revealed a basically new type of colloid- biochemical interaction—selective adhesion of colloidal particles to the surfaces of living cells. The selective heterocoagulation of living microorganisms with colloidal particles of metals and their compounds is regulated by chemical reaction—the generation of coordination, covalent bonds. It involves molecular, electrostatic, and chemical forces. Particularly intensive metallophilic properties are seen in the following processes, which are described: selective directed motion of colloidal particles relative to microorganisms, specific chemical attachment of colloidal particles to the surface of microorganisms, and flocculation of cells by particles of colloidal metals. The geochemical results of the metallophilic properties of the microorganisms include an accumulation of metals in ionic and colloidal forms by specialized planktonic metallophils, selective heterocoagulation of particles and assimilation of metal ions from flows, authogenic enlargement of noble metal particles and possible recrystallization of sulfides in finely dispersed marine sediments, and selective bonding of metals by soil-forming metallophils around ascending flows. Figures 13; References 30: 24 Russian, 6 Western.



UDC 541.18.02+548.23+539.371

**Physicochemical Rules of Structure Formation in Disperse Systems as Scientific Foundation for Increasing Strength and Durability of Material**

18410224C Moscow *ZHURNAL VSESOYUZNOGO KHIMICHESKOGO OBSHCHESTVA in Russian*  
Vol 34 No 2, Mar-Apr 89 pp 23-30

[Article by Ye. D. Shchukin, academician, Academy of Pedagogic Sciences, S. I. Kontorovich, candidate of chemical sciences, and Ye. A. Amelina, Institute of Physical Chemistry, USSR Academy of Sciences, Moscow State University imeni M. V. Lomonosov]

[Abstract] This review of the Soviet and Western literature discusses processes of the formation of disperse structures with contacts between phases and the influence of various physical and chemical factors on the elementary events of structure formation and the development of individual contacts between particles. This development of contacts producing three-dimensional grids is a characteristic feature of dispersed systems in that the strength of disperse porous structures is determined not so much by the strength of the material of the particles as by the strength of the contacts between them. The significance of mechanical stresses in the creation of dispersed structures and the use of porous materials are discussed. Figures 9; References 33: 21 Russian 12 Western.

UDC 541.18.622.331

**Colloid Chemistry in Peat Processing Technology**

18410224D Moscow *ZHURNAL VSESOYUZNOGO KHIMICHESKOGO OBSHCHESTVA in Russian*  
Vol 34 No 2, Mar-Apr 89 pp 48-53

[Article by I. I. Lishtvan, academician, Belorussian Academy of Sciences, and A. M. Abramets, A. M. Lych, and A. A. Terentyev, candidates of technical sciences, Institute of Peat, Belorussian Academy of Sciences]

[Abstract] Processing and production of a number of new materials is based on processes occurring at the colloid-chemical level, particularly processes that occur in natural dispersed materials with unstable properties such as peat. This article discusses colloid chemical problems on the basis of a report by the chairman of the Scientific Council of the USSR Academy of Sciences on colloid chemistry and physical-chemical mechanics that was read at a presidium of the USSR Academy of Sciences on 25 April 1985. It is supplemented by an analysis of the status of the science of colloids today and prospects for its development in the future. Figures 5; References 19: Russian.

UDC 541.182:621.318.1

**Colloid Ferromagnetics**

18410224E Moscow *ZHURNAL VSESOYUZNOGO KHIMICHESKOGO OBSHCHESTVA in Russian*  
Vol 34 No 2, Mar-Apr 89 pp 68-74

[Article by Ye. Ye. Bibik, professor]

[Abstract] Colloidal solutions have at least two distinguishing properties. First, any substance can be colloiddally dissolved in any other, not necessarily liquid, substance. Second, upon colloidal dissolution, a substance basically retains all of its inherent properties. Magnetic suspensions, i.e., colloidal solutions of small magnetic particles, have distinguishing features related to the magnetic interactions of the particles with each other and with magnetic fields. The rheologic properties of colloidal ferromagnetic materials are discussed. References 31: 25 Russian, 6 Western.

UDC 541.18

**Control of Structure Formation in Mineral Dispersions Using Water-Soluble Polymers and Surfactants**

18410224F Moscow *ZHURNAL VSESOYUZNOGO KHIMICHESKOGO OBSHCHESTVA in Russian*  
Vol 34 No 2, Mar-Apr 89 pp 75-81

[Article by E. A. Aripov, professor, F. L. Glekel, doctor of chemical sciences, and S. S. Khamrayev, Professor, Institute of Chemistry, Uzbek Academy of Sciences]

[Abstract] Mineral dispersions are heterogeneous systems with highly developed phase interfaces. Surface physicochemical phenomena are decisive in such systems. Interacting particles may form coagulation or condensation structures, depending upon the nature of the forces involved. Water-soluble polymers and surface-active agents may act as structure formers that intensify the primary coagulation structure, as plasticizers that suppress the formation of the primary structure, or as plasticizers that do not decrease the initial strength but that instead suppress the development of the primary structure and speeding hydration, thus increasing initial strength. References 36: 34 Russian, 2 Western.

UDC 541.183.02

**Colloid Chemistry of Proteins**

18410224G Moscow *ZHURNAL VSESOYUZNOGO KHIMICHESKOGO OBSHCHESTVA in Russian*  
Vol 34 No 2, Mar-Apr 89 pp 81-85

[Article by V. N. Izmaylova, professor, and G. P. Yampolskaya, candidate of chemical sciences, Moscow State University imeni Lomonosov]

[Abstract] Proteins are high-molecular mass surfactants with the ability to form interphase structures and solubilize the components of the nonpolar phase. As copolymers with nonrepeating monomers, proteins form compact, ideally balanced structures having both polar and nonpolar surface areas. The authors have calculated the forces of attraction and repulsion for model systems consisting of films and two interacting hydrocarbon droplets stabilized by proteins. There is a critical droplet size (2-3  $\mu\text{m}$ ) of the transition from state stability to

coagulation. The correlation of interphase adsorption layers with the stability of films, foams, and emulsions is established. Methods are developed for separating proteins and other biopolymers from enzymes and culture fluid in liquid water-hydrocarbon systems by the addition of surfactants. References 17: 15 Russian, 2 Western.

UDC 677.021.29/4-16:677.404.7

**Rheologic Properties of Solutions of Copolymers of Acrylonitrile With Vinylidene Fluoride and Mixtures of Their Homopolymers**

18410252D Tashkent UZBEKSKIY KHIMICHESKIY ZHURNAL in Russian No 3, May-Jun 89 (Manuscript received 9 Dec 88) pp 25-27

[Article by A. L. Ziyayev, M. K. Asamov, M. A. Tsagarayeva, and G. Khamrakulov, Tashkent State University imeni V. I. Lenin]

[Abstract] The rheologic properties of copolymers of acrylonitrile with vinylidene fluoride as well as mixtures of their homopolymers were studied. Flow curves of 15 percent solutions are presented. The effective viscosity of the mixture of polyacrylonitrile and polyvinylidene fluoride was lower than the effective viscosity of a solution, which was apparently due to the reduced interstructural interaction in the concentrated solution of the mixture of polymers due to their lower molecular mass. The data can be used to select optimal conditions for the preparation of spinning solutions for the formation of fibers. Figures 2; References: 3 Russian.

UDC 541.138

**Two-Pulse Galvanostatic Method of Studying Electrode Process Kinetics on Electroprecipitated Palladium**

18410206a Moscow ELEKTROKHIMIYA in Russian  
Vol 25 No 4, Apr 89 (manuscript received  
17 Dec 87) pp 452-58

[Article by O. A. Kopistko, Institute of Organic Catalysis and Electrochemistry, Kazakh Academy of Sciences, Alma-Ata]

[Abstract] A study is made of the kinetics of electrode processes on electroprecipitated palladium in simple aqueous solutions of perchloric acid forming no complexes and with no specific adsorption of anions by a two-impulse galvanostatic method. The experiments were performed in a 100-ml thermostatted quartz cell, the working electrode being the end of an Rh wire 0.5 mm in diameter with an area of  $1.96 \cdot 10^{-3} \text{ cm}^2$ , with the palladium electrolytically precipitated from a solution of  $10^{-1} \text{ M Pd}^{2+}$ ,  $10 \text{ M HClO}_4$  at  $10^{-5} \text{ A/cm}^2$  for 12-15 hours. The data indicate that the use of the two-impulse galvanostatic method allows study of the kinetics of the most rapid stage of transfer of the  $\text{Pd}^+$  ion in the overall process. The results also indicate that the kinetics of the palladium ion transfer stage are quantitatively described by the Butler-Volmer-Frumkin delayed discharge theory. Figures 5; References 25: 9 Russian, 16 Western.

UDC 541.138

**Significance of Kinetic and Diffusion Layers in Kinetics of Conjugate Electrochemical Reactions in Etching of Silicon in  $\text{HNO}_3$ -HF System**

18410206b Moscow ELEKTROKHIMIYA in Russian  
Vol 25 No 4, Apr 89 (manuscript received  
21 Apr 88) pp 479-87

[Article by S. O. Izidinov, A. M. Suskin, and V. I. Gaponenko, All-Union Electrical Engineering Institute imeni V. I. Lenin, Moscow]

[Abstract] Results are presented from a study of the process of etching under various hydrodynamic conditions to determine the variation in etching kinetics as a function of the ratio of diffusion and kinetic layers and etchant composition in which the etching rates at rest differ by 500-600 times ( $0.1$ - $60 \text{ } \mu\text{m/min}$ ). Experiments were performed in a Teflon cell with a thin polyethylene spiral on the inside wall to thermostat the etchant volume. The material relates the thickness of the kinetic and diffusion layers to the kinetics of the electrochemical reactions in an autocatalytic mechanism of  $\text{HNO}_3$  reduction. The etching rate of the silicon is limited by the cathodic or anodic conjugate reaction, which is determined by the composition of the etchant and the hydrodynamic conditions that determine the ratio of thicknesses of the diffusion and kinetic layers within which the oxidant is regenerated in the autocatalytic reduction process. Figures 7; References 19: 14 Russian, 5 Western.

UDC 541.135.52:546.87

**Charge and Potential Distribution in Binary Electrical Layer on Polycrystalline Bismuth-Drop-Type Electrode in Adsorption of Inorganic Ions**

18410206c Moscow ELEKTROKHIMIYA in Russian  
Vol 25 No 4, Apr 89 (manuscript received  
24 Mar 88) pp 507-09

[Article by M. G. Vyaertnyu, M. A. Salve, and U. V. Palm (deceased), Tartu State University]

[Abstract] A method is developed for determining differences in the charge and potential components in the double electrical layer on the individual parts of a polycrystalline electrode such as a bismuth drop in the case of adsorption of inorganic ions. A model electrode was studied that consisted of two different faces of a single crystal. The adsorption parameters were selected so that they corresponded to the experimental values found for faces of a bismuth single crystal. The results obtained from the model electrode agree well with a true bismuth drop electrode. References 19: 14 Russian, 5 Western.

UDC 541.138.2+541.44

**Anodic Behavior of Sodium Borohydride on Platinum Electrode**

18410206d Moscow ELEKTROKHIMIYA in Russian  
Vol 25 No 4, Apr 89 (Manuscript received  
3 May 88) pp 514-16

[Article by M. V. Ivanov and M. V. Tsionskiy]

[Abstract] Anodic oxidation of twice-recrystallized technical-grade  $\text{NaBH}_4$  was studied at  $25^\circ \text{C}$  in a  $1 \text{ M}$  solution of  $\text{NaOH}$  after preliminary electrochemical treatment on an Hg cathode with a current density of  $40 \text{ mA/Cm}^2$  for 5 hours. Current-time curves were generated. The position of the polarization curves with a slope of  $0.12 \text{ V}$  depends on the concentration of borohydride in the solution. The size of the  $0.12\text{-V}$  slope indicates that the rate of the  $\text{NaBH}_4$  oxidation process is determined by the electrochemical single-electron stage. The transition to a greater slope may result from the fact that the preceding chemical reaction includes at least two stages: equilibrium adsorption and decomposition of boron-containing adsorbed particles, forming atomic hydrogen. The results indicate that the  $\text{BH}_4^-$  is not electrochemically active in the area of potentials studied and decomposes due to quasiequilibrium chemical reactions leading to the formation of a particle participating in a delayed single-electron electrochemical stage. Figures 4; References 10: 6 Russian, 4 Western.

UDC 621.3.049.771.14.001.2

**Electrochemical Processing of Epitaxial Structures of Gallium Arsenide in Integrated Microcircuit Technology**

18410206e Moscow ELEKTROKHIMIYA in Russian  
Vol 25 No 4, Apr 89 (manuscript received  
14 Jun 88) pp 522-25

[Article by I. N. Sorokin, D. V. Tsvetkov, D. R. Shcherbachev, and N. G. Nazarov, Mosco Institute of Electron Technology]

[Abstract] A study is made of local photostimulated anodic oxidation of epitaxial gallium arsenide structures to optimize the conditions for conducting the process for the technology of gallium arsenide integrated circuit manufacture. Studies were performed in epitaxial gallium arsenide structures with an n-i-type(100) orientation and charge carrier concentration of  $1.2 \cdot 10^{17} \text{cm}^{-3}$  in the 0.2-0.3  $\mu\text{m}$  active layer. It is found that to deepen the gate in field-effect transistors, a process of local electrochemical anodization with subsequent dissolution of the oxide should be used. The oxidation regularities studied can support controlled thinning of the epitaxial layer with high substrate homogeneity and good morphology. Figures 4; References 12: 5 Russian, 7 Western.

UDC 541.135.5

**Electrochemical Properties of Interpolymer Sulfocationite Membranes in Anhydrous Electrolyte Solutions**

18410206f Moscow ELEKTROKHIMIYA in Russian  
Vol 25 No 4, Apr 89 (manuscript received  
25 May 88) pp 546-47

[Article by V. S. Kolosnitsyn, A. A. Yakovleva, and Yu. Ye. Nikitin, Institute of Chemistry, Bashkir Affiliate, USSR Academy of Sciences, Ufa]

[Abstract] A study is made of the properties of cation-exchange interpolymer membranes produced from linear polystyrene sulfoacid and polyvinyl chloride. The exchange capacity of the membranes was 2.5 mgEq/g. Electrochemical studies were performed at 40 °C in lithium bromide solutions in sulfolan, which has weak donor properties but a high ionizing capacity. The studies showed that the interpolymer membranes have good conductivity in anhydrous media. References 2: Russian.

UDC 541.135.4

**Limiting and Overlimiting Currents on Ion-Exchange Membranes in Acid and Alkaline Solutions**

18410206g Moscow ELEKTROKHIMIYA in Russian  
Vol 25 No 4, Apr 89 (manuscript received  
8 Jun 88) pp 547-50

[Article by V. D. Grebenyuk, E. K. Zholkovskiy, and N. P. Strizhak, Institute of Colloidal Chemistry and Water Chemistry imeni A. V. Dumanskiy, Ukrainian Academy of Sciences, Kiev]

[Abstract] In order to estimate the influence of local arrival of the system at the limiting state on the form of the voltage-current characteristic in an electron-membrane transport system, a study is made of a membrane around which a solution flows, assuming the concentrations beyond the diffusion layers to be identical on both sides of the membrane. Reduction of  $C_0$  and an increase in  $\delta$  is found to result in a clearly expressed plateau in the limiting state. Decreasing the flow rate and thus increasing the thickness of the diffusion layer does not determine  $\delta$ . The system is better described by a model of a constant-length diffusion layer and variable concentration in the flow. Experimental verification reveals three sections on the voltage-current characteristic as predicted. The overlimiting section is absent in 0.0 M NaOH, indicating satisfactory agreement of the calculated and experimental results. Figures 3; References 10: 4 Russian, 6 Western.

UDC 541.15+541.15

**Initial Electrical Polarization of Hemin Electron-Ion Pairs in Photoionization of Tetramethylparaphenylenediamine in Squalane**

18410208A Moscow KHIMICHESKAYA FIZIKA  
in Russian Vol 8 No 4, Apr 89 (Manuscript received  
30 Dec 87) pp 463-70

[Article by A. P. Chalov, L. V. Lukin, A. V. Tolmachev, and B. S. Yakovlev, Institute of Energy Problems of Chemical Physics, USSR Academy of Sciences; Institute of Inorganic Chemistry, Siberian Division, USSR Academy of Sciences, Novosibirsk]

[Abstract] A study is made of the early stages of ionization in a liquid before the formation of an equilibrium localized electron by measurement of the dipole moment of the initial pairs formed upon photoionization of tetramethylparaphenylenediamine (TMPD) in squalane in an external electric field. It is found that the mechanism of diffusion recombination agrees better with the experimental results than does the tunnel mechanism. Precise computation by the tunnel mechanism is difficult due to the lack of information on tunnel-transfer parameters. Figures 5; References 14: 6 Russian, 8 Western.

UDC 536.46

**Asymptotics of Steady Combustion Wave in Condensed Medium**

18410208D Moscow KHIMICHESKAYA FIZIKA  
in Russian Vol 8 No 4, Apr 89 (Manuscript received  
1 Feb 88) pp 525-532

[Article by A. M. Ilin, S. I. Khudyayev, Institute of Chemical Physics, USSR Academy of Sciences, Chernogolovka]

[Abstract] Construction of the asymptotics is presented for steady combustion of a condensed phase with a reaction order between 1 and 2, allowing any number of terms in the asymptotic series to be used by obtaining the mathematical basis. Three terms of the asymptotic expression are written explicitly. Additional terms can be constructed with merely technical difficulty. Construction of subsequent terms of the series will be described in a later article. References 15: 14 Russian, 1 Western.

UDC 534.222.2; 533.6.011

### Condensation Jumps Upon Combustion of Gas Suspensions of Aluminum Particles Beyond Shock Wave

18410208E Moscow *KHIMICHESKAYA FIZIKA in Russian Vol 8 No 4, Apr 89 (Manuscript received 16 Nov 87) pp 533-38*

[Article by Ye. A. Afanasyeva, All-Union Scientific Research Institute of Drilling Techniques, Moscow]

[Abstract] In a continuation of previous studies, the author suggests a mode of combustion of a gas suspension of aluminum particles with a completely or partially equilibrrious process of chemical condensation in the gas phase. The full structure of the heterogeneous detonation wave is studied under the assumption of the nonequilibrrious occurrence of the process of chemical condensation in the gas phase. The results are compared with similar calculations, assuming the equilibrrious formation of condensed  $Al_2O_3$  from the gaseous combustion products of the aluminum particles and also assuming that the structure of the wave is calculated without considering the condensation process in the gas phase. Condensation jumps are found to be possible in the combustion zone of the aluminum particles beyond the shock wave. The mechanism of the condensation jump is not the same as in the condensation of water vapor in expanding supersonic streams. Rather, it is related to the particle evaporation intensity and the explosive increase in the condensation rate in the combustion zone of the particles. Figures 4; References 6: Russian.

UDC 546.171:546.261:546.281

### X-Ray Electron Study of Coatings on Titanium, Obtained by Microarc Oxidation in Phosphate Electrolyte

18410213A Moscow *ZHURNAL NEORGANICHESKOY KHIMII in Russian Vol 34 No 4, Apr 89 (Manuscript received 4 Apr 88) pp 823-826*

[Article by M. P. Kandinskiy, P. S. Gordiyenko, and A. M. Ziatdinov]

[Abstract] Results are reported from an x-ray-electron spectroscopic study of microarc oxidation coatings on titanium and were recorded at a working pressure of  $5 \cdot 10^{-7}$  Pa in  $MgK_{\alpha 1,2}$  radiation at 1,253.6 eV. Element concentration

profiles were analyzed by spraying the specimens with argon ions with an energy of 2 keV. Comparison of the data with the corresponding data for  $TiO_2$  coatings made by the thermal method shows that the microarc-oxidized coatings contain titanium dioxide and phosphorus in the oxidized state as the major components, with no direct chemical bond between the titanium and phosphorus. The lack of direct bonds between the titanium and phosphorus apparently does not make the formation of indirect bonds such as Ti-O-P impossible. Phosphorus is chemically bonded with oxygen in the coatings studied. Figure 1; references 5: Western.

UDC 389:543.4

### Estimate of Random Component of Error in Photometric Determination of Phosphates in Wastewaters

18410215D Moscow *ZHURNAL ANALITICHESKOY KHIMII in Russian Vol 44 No 4, Apr 89 (Manuscript received 28 Jan 88) pp 650-654*

[Article by T. M. Levima, M. P. Klados, N. A. Miloserdova, and L. V. Konyakhina, Minudobreniya Scientific Production Association, Voskresensk]

[Abstract] An estimate is presented of the random component of error and the reproducibility of the method for determining phosphates in wastewaters when using a laboratory data base and the results of experiments performed by several laboratories on request. Some of the data of the laboratories contains systematic errors, and estimates of the reproducibility within and among laboratories are presented for the method involving the photometric determination of phosphates based on a light absorption measurement of the yellow phosphorus-vanadium-molybdenum complex. It is found that the reproducibility of the average result is quite high and the absolute value of standard deviation is small. The systematic errors result in a random error component of plus or minus 3.5 relative percent. Figure 1; References 5: Russian.

UDC 535.215.5

### Theory of Transitional Photocurrent in Organic Semiconductor Upon Homogeneous Absorption of Light in Specimen With Finite Photocarrier Generation Rate

18410275E Moscow *ZHURNAL FIZICHESKOY KHIMII in Russian Vol 43 No 8, Aug 89 (Manuscript received 5 May 87) pp 2169-74*

[Article by A. N. Asanov]

[Abstract] An analysis is presented of the theory of transitional photocurrent in an organic semiconductor

considering the delay in generation of photocarriers with respect to the exciting light pulse and the contribution of basic charge carriers generated behind the leading edge of the moving basic charge carriers, as well as the photocurrent resulting from motion of nonbasic carriers. The stimulating light pulse is considered to be infinitely short, with light uniformly absorbed in the specimen and finite rate of generation of photocarriers. The curve of the transitional photocurrent is shown to have a maximum that is determined by the position of the maximum on the time axis for various rates of photocarrier generation. References 6: 3 Russian, 3 Western.

#### Photoactivity of Thin Films of Phthalocyanine Metal Derivatives

18410275F Moscow ZHURNAL FIZICHESKOY  
KHIMII in Russian Vol 43 No 8, Aug 89 (Manuscript  
received 9 Dec 88) pp 2239-42

[Article by E. S. Apresyan, V. A. Ilatovskiy, and G. G. Komissarov, Institute of Chemical Physics imeni M. M. Semenov, USSR Academy of Sciences, Moscow]

[Abstract] The photovoltaic characteristics of metal complexes of phthalocyanines were measured to clarify the influence of the central atom on their photoactivity. Pigment films 50 nm thick were applied by thermal evaporation at  $10^{-6}$  torr onto platinum substrates 11 mm in diameter. The photocurrent and photopotential were measured in 0.1 M KCl with the addition of HCl or KOH at pH 0 to 14 with respect to a standard Ag/AgCl electrode. The photoactivity of the films was determined as a function of electrolyte pH and type of central atom. The influence of deaeration of the electrolyte on photoactivity and resistance of electrodes to discoloration was determined. It is found that photoactivity increases with weakening metal-ligand bond, decreasing electron density of the central atom, and increasing electron density of the ring. Coordination of the primary electron acceptor occurs not on the central atom, but rather on the ring of the molecule. Attachment of extra ligands with great affinity to the electrode increases the overlap of electron clouds of neighboring molecular layers and helps to increase the effectiveness of conversion of light energy in pigment films. Figure 1; References 3: 2 Russian, 1 Western.

UDC 541.14

#### Energy Characteristics of Photovoltaic Element Based on Zinc Phthalocyanine

18410275G Moscow ZHURNAL FIZICHESKOY  
KHIMII in Russian Vol 43 No 8, Aug 89 (Manuscript  
received 9 Dec 88) pp 2242-44

[Article by V. A. Ilatovskiy, E. S. Apresyan, and G. G. Komissarov, Institute of Chemical Physics imeni N. N. Semenov, USSR Academy of Sciences, Moscow]

[Abstract] The energy characteristics of Zn-Pc were measured, including the quantum yield, photocurrent,

loading, maximum power output, internal impedance of the photovoltaic cell, and efficiency of light energy conversion. The efficiency of an element is found to increase with increasing levels of illumination of the photocathode within the limits of linearity of the lux-ampere characteristic by up to 6.6 percent. The values of quantum yield, short-circuit photocurrent, photopotential, and efficiency of Zn-Pc thin-film elements are quite high for organic semiconductors. Figures 2; References 2: Russian.

UDC 541.182:621.3.035.82

#### Deposition of Colloidal Particles on Single Ionite Particle During Electrofiltration Process

18410154A Kiev KHIMIYA I TEKHOLOGIYA VODY  
in Russian Vol 11 No 2, Feb 89 (manuscript received  
11 Mar 88) pp 99-105

[Article by A. I. Gavriluk, Colloidal Chemistry and Hydrochemistry Institute, Kiev]

[Abstract] The advantages that electrofiltration has over conventional filtration have aroused applied, practical, and also theoretical interest in studying the behavior of colloidal systems in external electrical fields. Some authors have discussed the possibility of using nonconductive spherical collectors in filtration processes while others have presented a theoretical description of the effect of an electrical field on the electroconcentration of colloidal particles. The present work examines the behavior of a single ionite particle in a 1,1-electrolyte solution during the electrofiltration process. The contributions of the electro-, dipole-, diffusiophoretic, and electroosmotic transport mechanisms are examined. Numerical calculations of the critical angles of deposition of colloidal particles on the surface of the ionite granule demonstrate that the increase of the ionite's Donnan potential will be accompanied by a decrease in the area of the surface onto which the strongly charged colloidal particles tend to sediment. In the case of weakly charged particles, the efficient area of deposition increases along with the Donnan potential. Figures 3; references 22 (Russian).

UDC 628.165.001.24:532.71

#### Simulation of Reverse Osmosis Unit Operations With Roll Filter Elements

18410154B Kiev KHIMIYA I TEKHOLOGIYA  
VODY in Russian Vol 11 No 2, Feb 89 (manuscript  
received 29 Feb 88) pp 107-109

[Article by L. L. Muravyev, Chemical Machine Building SRI, Sverdlovsk]

[Abstract] Much experimental and theoretical material has been collected on desalination of water by reverse osmosis; however, this work is expressed in extremely difficult analytical terms containing many parameters that must first be determined. In the present work an

experimental mathematical simulation was developed that provides a sufficiently accurate description of the processes taking place within desalination units using roll-type filter elements. Relatively simple formulas for handling experimental data and computing separation processes, pressure skips, and permeability of roll filter elements are presented. Figures 2; references 1 (Russian).

UDC 628.162.5

#### **Precipitation of Coagulated Suspensions of Dissimilar Phase Composition**

18410154C Kiev *KHIMIYA I TEKHOLOGIYA VODY in Russian Vol 11 No 2, Feb 89 (manuscript received 3 Mar 89) pp 110-113*

[Article by L. Ya. Repetyuk, V. I. Maksin, and I. T. Goronovskiy, Colloidal Chemistry and Hydrochemistry Institute, Kiev]

[Abstract] The standing time of water in any individual stage of a surface water station is strictly limited. For this reason the time needed for coagulation of natural water impurities must agree closely with that used in passing through primary settling tanks. Several reagent methods exist for controlling the time needed for flocculent formation and impurity precipitation after the addition of flocculent. In the present work a study was made of the precipitation of suspended kaolinite, calcite, and goethite coagulants. Tests show that the duration of coagulate precipitation changes markedly if the phase composition of the suspension is altered. Water clarification time could be speeded up by the preliminary addition of chalk or natural oxides of iron. Figures 2; references 8 (Russian).

UDC 541.183.2

#### **Adsorption of Nonionogenic Surfactants and Cationic Dyes on Montmorillonite**

18410154D Kiev *KHIMIYA I TEKHOLOGIYA VODY in Russian Vol 11 No 2, Feb 89 (manuscript received 24 Nov 87) pp 113-115*

[Article by G. M. Klimova, I. Ya. Dimov, Yu. I. Tarasevich, and V. Ye. Doroshenko, Colloidal Chemistry and Hydrochemistry Institute, Kiev; Higher Institute of National Economy imeni D. Blagoyev, Varna]

[Abstract] Wastewater treatment by adsorption requires a greater variety of low-cost sorbents having improved properties, such as bentonite clays. They are known to have a high cation exchange capacity that may be effectively utilized to remove cationic dyes used in dyeing synthetic fibers and paper. In the present work a study was made of the adsorption of the nonionogenic surfactant OP-7 and malachite green dye on the Na and Ca forms of Kyrdzhalian (Bulgaria) and Cherkassian (UkSSR) montmorillonites. The results demonstrate that montmorillonite, a rock-forming mineral of bentonite clays, has a high adsorption capacity with respect to

nonionogenic and cationic dyestuffs. Figures 2; references 7: 6 Russian, 1 Western.

UDC543.544

#### **Gas Chromatographic Determination of Trace Quantities of Phenols in Treated Effluents With Two-Stage Preliminary Concentration**

18410154E Kiev *KHIMIYA I TEKHOLOGIYA VODY in Russian Vol 11 No 2, Feb 89 (manuscript received 15 Sep 87) pp 118-120*

[Article by Ya. I. Korenman and V. N. Fokin, Voronezh Technological Institute]

[Abstract] Phenol, cresols, and xylenols are toxins present in many industrial effluents. The maximum permissible concentrations for these substances vary from 0.004 to 0.001 mg/l. Water containing as much as 0.01-0.02 mg/l phenols does not have the odor and taste of the phenols, and this makes them dangerous. The total phenol content is frequently determined by distillation of a water sample, determination of the monohydric (volatile) phenol, formation of colored compounds, extraction with chloroform, and measurement of the optical density of the extract. Although this method yields information on the content of individual phenols, the concentration is calculated on the basis of pure phenol, while the maximum permissible concentrations of phenols, cresols, and xylenols differ markedly from each other. Chromatography can be used to determine 8-10 different phenols in one sample with an error not in excess of 20 percent. Natural and potable water must first be concentrated 1,000-fold or more. Known chromatographic methods require three-stage concentration, i.e. extraction, re-extraction, and extraction again, and this results in a 50 percent loss and requires 1.5 hours' time. In the present work a two-stage concentrating technique includes extraction with diethyl or isopropyl ether and evaporation of the solvent. To decrease phenol losses during vaporization, alcoholic alkali solution is added to the extract prior to vaporization, the volatility of the resulting phenolates being much less than that of corresponding phenols. The procedure takes 40 minutes and is recommended for plant laboratories to monitor industrial effluents. Figure 1; references 8: 6 Russian, 2 Western.

UDC 628.543

#### **Treating Gas Field Effluents to Remove Methanol**

18410154N Kiev *KHIMIYA I TEKHOLOGIYA VODY in Russian Vol 11 No 2, Feb 89 (manuscript received 1 Aug 86, after revision 11 Feb 88)*

[Article by M. N. Timoshchenko and A. V. Shpak, Colloidal Chemistry and Hydrochemistry Institute, Kiev]

[Abstract] Connate water remaining after gas separation contains 50 to 300 mg/l methanol. The allowable concentration of methanol in water must not exceed 3 mg/l, while biological treatment facilities cannot accept waste water containing over 200 mg/l methanol. Effluents containing 2 to 60 g/l methanol are treated by regeneration, destruction, and extraction where aliphatic alcohols are ozonized into aldehydes and acids. While this method can be recommended for effluents containing butyl and higher alcohols, it is not suitable for methanol, which forms formaldehyde and is not entirely eliminated by ozone blowing. In the present work a method is proposed for treating effluents containing up to 320 mg/l methanol. The methanol-containing effluent is preheated to 60°C and cycled through a desorber. After blowing off up to 98 percent of the methanol, the water is shunted either for industrial use or further biological treatment. Figure 1; references 8 (Russian).

UDC 546.426

#### Development of Water Analysis Methods in 1987

18410216A Kiev *KHIMIYA I TEKHOLOGIYA VODY* in Russian Vol 10 No 6, Nov-Dec 88 (Manuscript received 26 Jul 88) pp 497-532

[Article by A. V. Terletskaia, Institute of Colloid Chemistry and Water Chemistry imeni A. V. Dumanskiy, Ukrainian Academy of Sciences, Kiev]

[Abstract] This review continues an annual series of reviews on the worldwide development of water analysis methods and includes basic research on methods of water analysis published from January through December of 1987 in the Soviet and Western literature. The section on inorganic analysis analyzes methods of determining alkaline, alkali-earth, transition, and noble metal lanthanides; radioactive nuclides; anions; and gases. The section on organic analysis presents data on the use of gas and liquid chromatography, mass spectrometry, photometry, and other methods. Methods of determining individual groups of contaminants are studied, as are problems of specimen selection, concentration, isolation, and separation of various components. References 428: 110 Russian, 318 Western.

UDC 543.3:535.379

#### Determination of Iodides in Water by Gas Extraction of Iodine With Chemiluminescent Detection

18410216B Kiev *KHIMIYA I TEKHOLOGIYA VODY* in Russian Vol 10 No 6, Nov-Dec 88 (Manuscript received 27 May 88) pp 533-535

[Article by A. T. Pilipenko, A. V. Terletskaia, and O. V. Zuy, Institute of Colloid Chemistry and Water Chemistry imeni A. V. Dumanskiy, Ukrainian Academy of Sciences, Kiev]

[Abstract] A chemiluminescent method is developed to determine iodides. The method is based on the oxidation of luminol by cyanogen iodide. The humic acids and hardness salts hinder chemiluminescence, increasing the limit of detection to 0.02 mg/l. Oxidation of iodides to iodine with gas extraction and chemiluminescent detection in a carrier gas stream by the reaction with luminol improves the limit of detection without greatly increasing the analysis time. A diagram of an apparatus for this purpose is presented. It was used to determine iodides in drinking water, groundwater, river water, sea water, and mineral waters, and it was found to be accurate, simple to perform, highly sensitive, and very rapid (determination time, 1 minute). The process could be easily automated. Figures 2; References 10: 8 Russian, 2 Western.

UDC 543.544+543.38

#### Gas-Chromatographic Method of Analyzing Wastewater for Nekal Content

18410216C Kiev *KHIMIYA I TEKHOLOGIYA VODY* in Russian Vol 10 No 6, Nov-Dec 88 (Manuscript received 20 May 87; in final form 17 Jun 88) pp 539-541

[Article by E. F. Yakubenok, V. S. Sukhov, I. I. Starovoytov, V. P. Svatikov, and N. V. Popova, Voronezh Institute of Technology]

[Abstract] A gas-chromatographic method is developed to analyze wastewaters for their content of Nekal, which is a mixture of sodium salts of mono-, di-, and tributyl naphthalene sulfoacids that is used as an anion-active surfactant. The method is based on the process of desulfuration of the butyl naphthalene sulfoacids to the corresponding butyl naphthalenes. The method was found to be effective at the concentrations studied. Figure 1; References: 4 Russian.

UDC 628.162.8

#### Simplified Technology for Purifying Wastewaters of Pesticides

18410216D Kiev *KHIMIYA I TEKHOLOGIYA VODY* in Russian Vol 10 No 6, Nov-Dec 88 (Manuscript received 26 Nov 87) pp 542-544

[Article by P. N. Taran, V. F. Vakulenko, A. V. Grechko, M. A. Shevchenko, and V. V. Goncharuk, Institute of Colloid Chemistry and Water Chemistry imeni A. V. Dumanskiy, Ukrainian Academy of Sciences, Kiev]

[Abstract] Shops involved in the maintenance and cleaning of agricultural equipment that is used to transport and apply pesticides create small volumes of contaminated wastewater. Considering the small volumes, the possibility was tested of using simplified technological systems to purify the water, particularly sorption processes using peat or carbon filters with subsequent



UV treatment of the water. The effectiveness of the purification was studied under static conditions with absorption in two stages plus photochemical oxidation of organic substances by UV irradiation. The technology is successful but is only economical where small quantities of water are involved. Figure 1; References 5: Russian.

UDC 625.359.7

#### **Laser Installation for Monitoring and Regulating Chalk Seed Flow in Desalination Equipment**

18410216E Kiev *KHIMIYA I TEKHOLOGIYA VODY* in Russian Vol 10 No 6, Nov-Dec 88  
(Manuscript received 29 Jan 87) pp 555-557

[Article by V. V. Teselkin, A. A. Samarkin, I. G. Vakhnin, V. I. Maksin, Yu. S. Baranov, and V. V. Volodchenko, Institute of Colloid Chemistry and Water Chemistry imeni A. V. Dumanskiy, Ukrainian Academy of Sciences, Kiev]

[Abstract] A laser installation is described for continuous monitoring of the concentration of chalk seed used in a desalination installation. The automatic monitoring and controlling installation is suitable for use in automatic process control systems that use optical methods based on the absorption and scattering of light as monochromatic light passes through a cuvette containing the suspension of chalk. The intensity of the transmitted light flow is found to be proportional to the square of the particle diameter and the cube of particle concentration. The installation developed measures both the absorption and scattering of light simultaneously, yielding information both on the concentration and the particle-size distribution of the suspensions. Figures 2; References 4: Russian.

UDC 66.087.7:628.54:661.184.123

#### **Breakdown of Dyes in Electrochemical Purification of Wastewater**

18410217A Kiev *KHIMIYA I TEKHOLOGIYA VODY* in Russian Vol 11 No 4, Apr 89 (Manuscript received 25 Apr 88) pp 311-15

[Article by T. A. Kharlamova, N. I. Mitashova, L. F. Filimonova, T. G. Novosadova, and N. L. Struchkova, State Scientific Research Institute of Nonferrous Metals]

[Abstract] A study is presented of the breakdown of dyes during the electrochemical purification of wastewater to determine the possible causes of toxicity of the purified water. Insoluble plate-type graphite anodes were used to purify model solutions containing 0.2-30.0 g/l dye and 5.0 g/l sodium chloride. Electrolysis was conducted at 2.0 A/cm<sup>2</sup>, voltage not over 4.0 V. It was found that even after clarification to the standards established for dumping into the sewer, the wastewaters contained high residual concentrations of difficultly soluble organic compounds. At anode potentials of less than 1 V, the aromatic nature of the dyes was retained even after the

color was lost. The aromatic component can be broken down to nontoxic carboxylic acids by electrochemical oxidation. The method of direct oxidation is considered most promising for future development. Figures 2; References 8: Russian.

UDC 531.71+66.083.2

#### **Influence of Electrolyte Solution Concentration and Temperature on Permeability and Selectivity of Reverse-Osmotic Membranes**

18410217B Kiev *KHIMIYA I TEKHOLOGIYA VODY* in Russian Vol 11 No 4, Apr 89 (Manuscript received 21 Jul 88) pp 315-18

[Article by N. I. Prokhorenko, M. A. Korbutyak, N. V. Churayev, and D. D. Kucheruk, Institute of Colloid Chemistry and Water Chemistry imeni A. V. Dumanskiy, Ukrainian Academy of Sciences, Kiev; Institute of Physical Chemistry, USSR Academy of Sciences, Moscow]

[Abstract] A study is made of the influence of temperature from 20 to 50°C on the throughput of type MGA-100, MGA-70, and UAM-150 membranes and their selectivity for various concentrations of solutions of KCl, NaCl, MgCl<sub>2</sub>, and MgSO<sub>4</sub>. Experiments were performed on a continuous-flow reverse-osmotic installation. The change of viscosity with temperature in the pores of the membranes are related to weakening of the grid of hydrogen bonds. The ordinary thermal effect characteristic for water in a free volume is also supplemented by the influence of thermal restructuring due to the field of surface tension; this causes an additional drop in viscosity. The results indicate that the state of the solution in the pores and the structure of the membrane are quite sensitive to solution concentration and temperature. Both effects must be considered in analyzing the selective properties of a membrane and selecting optimal conditions for the separation of various solutions. Figures 2; References 9: 8 Russian, 1 Western.

UDC 632.95.028

#### **Photolysis of 4-Aminopyridine in Aqueous Media**

18410217C Kiev *KHIMIYA I TEKHOLOGIYA VODY* in Russian Vol 11 No 4, Apr 89 (Manuscript received 7 May 88) pp 318-320

[Article by N. M. Soboleva, A. A. Nosonovich, and V. V. Goncharuk, Institute of Colloid Chemistry and Water Chemistry imeni A. V. Dumanskiy, Ukrainian Academy of Sciences, Kiev]

[Abstract] A study is made of the photolysis of 4-aminopyridine in aqueous media at 25°C under the

influence of UV light. Irradiation of the solutions causes rapid destruction of the preparation, and this is accompanied by a decrease in the intensity of the main bands at  $48,560\text{ cm}^{-1}$  and  $38,000\text{ cm}^{-1}$ . It is assumed that the deamination process starts by the splitting of the amino groups from the molecules of the toxicant, thus forming the equivalent quantities of ammonia. The initial deamination rate increases as the 4-aminopyridine concentration increases. Photolysis is highly effective, particularly when hydrogen peroxide is present in small quantities. Figures 5; References 9: 5 Russian, 4 Western.

UDC 543+535.379

#### Chemiluminescent Methods of Determining Components in Water

18410217D Kiev KHIMIYA I TEKHNLOGIYA VODY in Russian Vol 11 No 4, Apr 89 (Manuscript received 3 Oct 88) pp 321-29

[Article by A. T. Pilipenko and O. A. Zaporozhets, State University imeni T. G. Shevchenko, Kiev]

[Abstract] This review of the Soviet and Western literature discusses the theoretical principles, practical capabilities, and major areas of application of the chemiluminescent analysis of water components. The determination of metals, nonmetals, and organic compounds is discussed. The chemiluminescent reactions suggested for each compound in the various classes are briefly described. Limits of detection are presented for most substances, and substances hindering determination are noted. Reference 84: 34 Russian, 50 Western.

UDC 543.8

#### Enzymatic Methods of Determining Organophosphorus Compounds in Natural and Wastewaters

18410217E Kiev KHIMIYA I TEKHNLOGIYA VODY in Russian Vol 11 No 4, Apr 89 (Manuscript received 11 Dec 86; in final form 2 Dec 88) pp 329-336

[Article by A. A. Tumanov and Ye. A. Korostyleva, Scientific Research Institute of Chemistry, Gorkiy]

[Abstract] This review of the Soviet and Western literature summarizes information on enzymatic methods of determining organophosphorus compounds in the analysis of both natural and wastewaters. Enzymatic methods are kinetic methods of analysis utilizing the variation in the rate of a chemical reaction as a function of the concentration of the reacting substances. The basis of the enzymatic methods of determining organophosphorus compounds is their ability to inhibit cholinesterase activity. The methods allow a determination of microscopic quantities of biologically active products of the metabolism of the initial pesticides as well as the

pesticides themselves. Enzymatic methods are developing in the direction of automated, rapid, highly sensitive, and selective analysis. They can be used in combination with modern detector systems for the creation of simple, reliable, inexpensive analytic methods. References 45: 18 Russian, 27 Western.

UDC 543.862:553.7(477.82)

#### Determination of Naphthenic Acids in Mineral Waters From Carpathian Region

18410217F Kiev KHIMIYA I TEKHNLOGIYA VODY in Russian Vol 11 No 4, Apr 89 (Manuscript received 14 Sep 88) pp 336-37

[Article by Ya. I. Korenman, K. I. Zhilinskaya, and Ye. I. Medvedeva, Voronezh Institute of Technology; Scientific Research Institute of Health Resort Science, Odessa]

[Abstract] A method is suggested for determining naphthenic acids: a known volume of water to be analyzed is acidified with a 5 M solution of hydrochloric acid to pH 3.5 and placed in a separating funnel. Next, 50 ml of petroleum ether is added, and the mixture is extracted with vibration at  $20^{\circ}\text{C}$ . An equal portion of petroleum ether is added to the equilibrium aqueous solution and reextracted. The extracts are combined and placed in a separating funnel. Next, 10 ml of 0.1 M sodium hydroxide is added, the naphthenic acids are reextracted for 3 minutes, and the reextract is separated and acidified with 0.5 ml of 5 M hydrochloric acid. The content of naphthenic acids is found nephelometrically. References 10: Russian.

UDC 62-278:628.165

#### Estimate of Properties of MK-40-4 and MA-411 Membranes in Desalination of Black Sea Water

18410217G Kiev KHIMIYA I TEKHNLOGIYA VODY in Russian Vol 11 No 4, Apr 89 (Manuscript received 23 May 88) pp 360-362

[Article by T. Sh. Kharebava, I. N. Tavartkiladze, M. G. Dzhikidze, N. V. Chkheidze, and E. M. Balavadze, Scientific Research Institute of Plastics, Plastmassy Scientific Production Association, Moscow; Batumi Department of Scientific Research Institute of Plastics, Plastmassy Scientific Production Association, Batumi]

[Abstract] Resource testing was performed on membranes used in the desalination of Black Sea water. The tests were performed on two identical model electrodialysis apparatus under identical conditions. The selectivity of the experimental membranes decreased significantly during testing in contrast to industrial membranes. This was probably due to the washing of the low-molecular mass fractions from the membranes and the formation of free channels through them. The techniques of manufacturing the membranes are said to have improved significantly since the membranes used in the

tests were made. In spite of the decrease in selectivity after 15,000 hours of use, the economic characteristics of the experimental membranes are superior to those of the industrial membranes with which they were compared. Figure 1; References 4: Russian.

UDC 628.353.153

### Denitrification of Wastewater From Petrochemical Plants

18410217H Kiev *KHIMIYA I TEKHNLOGIYA VODY in Russian Vol 11 No 4, Apr 89 (Manuscript received 18 Mar 88) pp 365-66*

[Article by N. A. Zaripova and M. V. Novikova, Leningrad Scientific Production Association, Leningrad]

[Abstract] A study was made to determine the methanol consumption required for denitrification of wastewaters and the necessary duration of the process. Experiments were performed in a laboratory model aeration tank that received wastewater containing nitrogen as nitrates and 2-6 percent nitrites. Denitrification occurred to approximately 50 percent in 4 hours as measured by residual nitrate nitrogen. Denitrification must therefore be continued for 8 hours to reach the applicable water quality standards. References 7: 3 Russian, 4 Western.

UDC 576.8.22:828.162.8

### Dose-Time Dependence of Effect of Silver in Water on Pathogenic Escherichia

18410217I Kiev *KHIMIYA I TEKHNLOGIYA VODY in Russian Vol 11 No 4, Apr 89 (Manuscript received 8 Jan 88) pp 366-369*

[Article by M. G. Potapchenko, L. V. Grigoryeva, O. S. Savluk, and L. A. Kul'skiy, Institute of Colloid Chemistry and Water Chemistry imeni A. V. Dumanskiy, Ukrainian Academy of Sciences; Institute of Communal Hygiene imeni A. N. Marzeyev, Ukrainian Ministry of Public Health, Kiev]

[Abstract] A study is made of the resistance to silver of 44 strains of pathogenic Escherichia and the dose-time variation of action of silver ions in water on strains with varying sensitivity to silver. The antimicrobial effect of the silver in water was determined by the method of serial dilutions. The most effective dose of silver for decontamination was 0.1 mg/l, although water can be preserved by a dose as low as 0.05 mg/l. A slight decrease to less than 0.05 mg/l causes a sharp drop in antimicrobial effect. Figures 4; References 10: 4 Russian, 6 Western.

UDC 662.764.074.371

### Determining Activity of Absorbing Solution for Arsenic-Soda Sulfur Removal

18410221A Moscow *KOKS I KHIMIYA in Russian No 4, Apr 89 pp 25-28*

[Article by L. O. Sokolik, T. Yu. Spirina, and Ye. I. Vayl, Ukrainian Chemical Scientific Research Institute, and S. A. Ovchinnikova and V. N. Maybanyuk, Zaporozhye By-Product Coke Plant]

[Abstract] The authors have developed a new method for determining the activity of the absorbing solution used to remove hydrogen sulfide from gases by the arsenic-soda method. The new method is based on the interaction of the reactive components of the absorbing solution with excess hydrosulfide ions. The difference between the quantity of sulfide ions added to the solution and the quantity not entering the reaction is used to determine the activity, which is expressed in grams of hydrogen sulfide per dm<sup>3</sup> of absorbing solution. Experiments at the central plant laboratory of the Zaporozhye By-Product Coke Plant indicated that higher values of calculated activity did correspond to higher degrees of purification of coking gas. The analysis required to determine activity takes just 20 minutes. Figures 2; References 8: Russian.

UDC 662.74:622.793.5

### Utilization of Arsenic-Soda Sulfur Purification Wastewaters

18410221F Moscow *KOKS I KHIMIYA in Russian No 4, Apr 89 pp 52-53*

[Article by I. G. Karutko, Mariupol Coke and Chemical Plant]

[Abstract] Decontamination of wastewater from arsenic-soda sulfur purification producing copper thiocyanate yields a solution containing 130-160 g/dm<sup>3</sup> sodium sulfate, 90-110 g/dm<sup>3</sup> sodium polythionates, 0.8-1.2 g/dm<sup>3</sup> complex copper compounds, and 1.0-1.8 g/dm<sup>3</sup> sulfuric acid. A technological plan is developed for processing this solution to produce sodium sulfate and concentrated thiosulfate solution. The process includes alkaline decomposition, filtering, evaporation, centrifugation, and drying. An experimental batch of sodium sulfate was produced for use in the paper and glass industries. Figure 1, table 1.

UDC 628.5.008

### Methods of Environmental Protection

18410222F Moscow *KHIMIYA I TEKHNLOGIYA TOPLIV I MASEL in Russian No 4, Apr 89 p 15-16*

[Article by V. I. Kostyuk, All-Union Scientific Research, Production, and Design Institute of Petrochemistry]

[Abstract] A system of scientific research and development studies has been directed toward reducing environmental pollution of existing and newly created technologies. Examples are listed, including the elimination of pollution by electric desalination installations, the development of water-miscible lubricating and cooling fluids, the study of the waste water produced by production facilities manufacturing additives, the development of a technology for producing a rubber stabilizer from the still residue generated in the production of Agidol-2, and the development of two-stage cyclone units for the thermal decontamination of gases from the oxidation of bitumen and the production of synthetic fatty acids.

UDC 628.387.445

**Purification and Reuse of Nickel-Chromium-Containing Wastewater With Production of Mineral Fertilizer**

18410252F Tashkent *UZBEKSKIY KHIMIICHESKIY ZHURNAL* in Russian No 3, May-Jun 89 (Manuscript received 08 Apr 88) pp 54-58

[Article by S. M. Shamsiyev, G. M. Musayeva, and A. A. Urunova, Tashkent Affiliate, All-Union Scientific Research Institute of Water Supply, Sewerage, Water Development Works, and Engineering Hydrogeology]

[Abstract] Considering the distribution of the chromate, nitrate, sodium, nickel, zinc, copper, and aluminum ions in the wastewater from the production of nickel-chromium catalyst, a study was made of the sorption of metal ions on KU-2 and KD-4 P-2 cationites in both H and Na forms, with absorption of anions on AV-17 and AM-31 anionites with various basicities. The conditions of the separation of the ions were determined. The method developed allows chromium to be isolated while

producing metal nitrates, ammonium nitrate, and desalinated water. The capital cost of an industrial installation with a capacity of 238,300 m<sup>3</sup>/yr is 132,500 rubles, its operating costs are 162,100, and it has an economic effect of 900,000 rubles per year. Figures 2; References 7: Russian.

UDC 628.33.067

**Installation for Physicomechanical Purification of Wastewater To Remove Petroleum Products**

18410271G Moscow *KHIMIYA I TEKHNLOGIYA TOPLIV I MASEL* in Russian No 8, Aug 89 pp 44-45

[Article by N. V. Barsukova, Z. I. Niidusaar, K. Ye. Zvyagin, and I. N. Myasnikov, All-Union Scientific Research Institute of Water Supply, Sewerage, Water Development Works and Engineering Hydrogeology, State Committee on Petroleum Products, Estonian SSR]

[Abstract] A pilot-scale installation for the physicomechanical purification of wastewater has been in use at a petroleum center for more than 2 years. It consists of two coalescence filters, one of which is loaded with granules of clay filler and the other of which is loaded with polystyrene granules plus a flotation installation. The effectiveness of water purification on this installation was studied as a function of the concentration of petroleum products, temperature, and flow rate of the water and dosage of reagents used in the flotation section. Most of the petroleum products leave the device with the foam product, with small quantities forming a precipitate. The effectiveness is high and stable in the summer but deteriorates as water temperature drops in the winter. The major advantages of the installation include the ability to recycle petroleum products, its compact size, and ease of use. The economic effect of the installation is 102,000 rubles per year. Figure 1; References 3: Russian.

UDC 669.284

**Kinetics of Removal of Oxygen and Carbon From Molybdenum by High-Frequency Vacuum Levitation**

18410264E Moscow VYSOKOCHISTYYE

VESHCHESTVA in Russian No 3, May-Jun 89

(Manuscript received 6 May 88) pp 114-24

[Article by I. V. Kapchenko, V. G. Glebovskiy, V. V. Kireyko, and V. A. Ryzhkov, Institute of Solid-State Physics, USSR Academy of Sciences, Chernogolovka]

[Text] A study is presented of the kinetics of the removal of O and C from liquid Mo under high-vacuum conditions, and the possibility is demonstrated of using highly sensitive activation methods for analysis of O and C over a broad concentration range. The installation used for high-frequency levitation consisting of a multiposition vacuum chamber with a double-coil inductor and a vacuum-tube 100-kW, 220-kHz generator. The residual pressure in the chamber during levitation was  $(6-9) \cdot 10^{-3}$  Pa. The range of concentrations of the impurities that could be recorded was  $10^{-1}$  to  $5 \cdot 10^{-6}$  mass percent. The possibility is demonstrated of producing molybdenum with the desired concentration of oxygen and carbon within this range. The effective rate constant of removal of oxygen from the liquid molybdenum is determined. Figures 6; References 31: 25 Russian, 6 Western.

UDC 541.047.7.546.28.21

**Activated Oxidation of Silicon. 2 Communication. Effect of Temperature and Oxygen Concentration**

18410214a Moscow ZHURNAL FIZICHESKOY

KHIMII in Russian Vol 63 No 4, Apr 89 (manuscript

received 2 Mar 88) pp 1061-1064

[Article by V. M. Belova, Ye. A. Rubtsova, E. S. Lonskiy, N. S. Karaseva, and L. I. Nekrasov, Department of Chemistry, Moscow State University imeni M. V. Lomonosov]

[Abstract] Experimental results were reported on the relatively rapid oxidation (in comparison to the thermal process) of silicon in media that was activated in a condensed discharge at temperatures of 100 to 800°C, and that contained argon or nitrogen in addition to oxygen; data on the effect of temperature and the composition of the gas phase are reported. The oxidation was carried out with atomic oxygen diluted with molecular nitrogen, with activated oxygen, and with activated mixtures of oxygen and argon or nitrogen. The results showed that identical contact time with the oxidizing medium at steady gas pressures resulted in an increased thickness of the oxide layer as the temperature increased. The oxidation rate appeared to be related to the composition of the gas phase. The temperature relationship observed can be explained by processes occurring in the solid phase of the reacting medium. The effect of gas phase composition on the oxidation rate can be

explained by the possible participation of atomic nitrogen in the overall process as a gas-diluent of the oxidizing component. Figures 2; references 5: 1 Russian, 4 Western.

UDC 666.646

**Use of Mathematical Modeling in Development of Ceramics**

18410252G Tashkent UZBEKSKIY KHIMIICHESKIY

ZHURNAL in Russian No 3, May-Jun 89 (Manuscript

received 29 Jan 88) pp 59-62

[Article by A. M. Eminov, A. K. Abdurakhmanov, T. A. Atakuziyev, A. S. Dzhalilov, and T. I. Islamov, Tashkent Polytechnical Institute imeni Abu Raykhan Berun]

[Abstract] Compositions were developed for ceramic products based on thermophosphogypsum slag generated from phosphogypsum waste formed in the production of phosphorus fertilizer by roasting in the presence of power plant ash and coal. The compositions were developed by mathematical modeling and by studying the influence of the slag on the basic properties of ceramic tiles, including water absorption, shrinkage, and mechanical strength. Experimental data from the manufacture and testing of 150 X 150 X 5 mm tiles were used to develop mathematical models adequately describing the variation in properties of the tiles as functions of manufacturing conditions. It was found that the introduction of the slag with rapid drying and roasting on conveyer lines allows the manufacture of tiles satisfying the requirements of the state standards. This allows expansion of the raw materials base, decreases transportation costs, and thereby reduces the cost of the end product. Figure 1; References 5: Russian.

UDC 66.01.004.68

**Synthesis of Flexible Technological Process for Producing Highly Pure Calcium and Barium Carbonates**

18410264D Moscow VYSOKOCHISTYYE

VESHCHESTVA in Russian No 3, May-Jun 89

(Manuscript received 28 Jun 88) pp 79-85

[Article by V. A. Falin, A. A. Fakeyev, and V. P. Meshalkin, All-Union Scientific Research Institute of Chemical Reagents and Highly Pure Chemical Substances, Moscow]

[Abstract] This work presents, apparently for the third time, a description of a new technological method for producing highly pure carbonates of alkali and alkali-earth elements, including the following: preparation of the initial reagents, chemical reaction of the corresponding nitrate with gaseous CO<sub>2</sub> and NH<sub>3</sub>, filtration of carbonate suspensions, washing of carbonate pastes, drying of carbonate pastes, processing of the mother liquor, and ensuring full utilization of the initial reagents. In contrast to previously known multistage

batch methods, this method is continuous, achieves high product yield and complete raw material utilization, is highly automated, and uses little manual labor. A diagram of the process equipment and flowchart of the algorithm used to synthesize the process are presented. Figures 2; References 11: Russian.

UDC 621.315.592

### **Production of High-Purity Silicon Single Crystals by Crucibleless Zone Melting**

18410264F Moscow VYSOKOCHISTYYE  
VESHCHESTVA in Russian No 3, May-Jun 89  
(Manuscript received 9 Aug 88) pp 129-35

[Article by Yu. V. Trubitsyn, K. N. Neymark, and I. F. Chervonyy]

[Abstract] From the moment of discovery of ionization in a solid in 1955 and the realization of the possibility of using semiconductor materials as elementary particles recording elements, requirements for highly pure single crystals have increased. Such single crystals are now produced by crucibleless zone melting and have a resistivity of at least 1,000 ohms·cm for both n- and p-type conductivity. The status of the production of silicon in the West is discussed. The basic obstacles to further development of the technology for production of detector-quality silicon are unavailability of certification measurement methods for high-resistance silicon single crystals of large diameter, shortage of facilities for the physical investigation of materials, lack of specialized organizations performing neutron-transmutation doping of silicon, scattering of consumers, variations in technical conditions for materials produced, insufficiently well founded requirements for material quality, and lack of feedback from consumers to manufacturers of the materials. References 11: 9 Russian, 2 Western.

UDC 661.939

### **Production of Highly Pure Neon**

18410264G Moscow VYSOKOCHISTYYE  
VESHCHESTVA in Russian No 3, May-Jun 89  
(Manuscript received 28 Nov 88) pp 141-43

[Article by S. A. Arutyunov (deceased), V. A. Yegorov, Ya. D. Zelvenskiy, and V. V. Shitikov, Moscow Institute of Chemical Technology imeni D. I. Mendeleyev]

[Abstract] In order to improve the production of neon, the authors, in cooperation with the Balashikhino oxygen plant, have developed, installed, and put into operation an installation for the production of high-purity neon from a neon-helium mixture. The continuous process includes a neon cooling cycle by choking following preliminary liquid-nitrogen cooling and a separator-condenser and a packed desorption column to distill the dissolved helium from the liquid neon. Operation of the installation is briefly described. The installation can produce up to six m<sup>3</sup>/stp of high-purity neon per hour, extracting about 97 percent of the neon from the input mixture. The content of neon in the output product is 99.994 mol. percent, helium not over 50 parts per million, hydrogen less than 1 ppm, oxygen less than 1 ppm, nitrogen less than 3 ppm, carbon dioxide less than 0.1 ppm, methane less than 0.1 ppm, and water vapor less than 2 ppm. Figure 1; References 4: 3 Russian, 1 Western.

UDC 537.311.33:536.5

### **Temperature Variation of Relative Elongation of High-Purity Silicon**

18410265A Moscow VYSOKOCHISTYYE  
VESHCHESTVA in Russian No 4, Jul-Aug 89  
(Manuscript received 9 Aug 88) pp 5-7

[Article by Yu. N. Taran, V. Z. Kutsova, K. I. Uzlov, E. S. Falkevich, and B. L. Shklyar]

[Abstract] A study is made of the variation in relative elongation of high-purity silicon when heated to 1,200 °C at 10 °C/min in a vacuum chamber. Analysis of the dilatometric curves indicates that there are four temperature intervals in which the temperature variation of relative elongation differs from linear. The anomalies are probably related to various transformations of second-phase inclusions in the silicon. The authors are presently continuing their studies with calorimetric, x-ray structural, and other analysis methods to determine the nature of the anomalies found in the variation of relative elongation of high-purity silicon. Figure 1; References 3: 2 Russian, 1 Western.

543.544

**Sorption of Copper (II) From Peroxide-Containing Solutions on EDTA-Type Anionite**

18410241A Tbilisi IZVESTIYA AKADEMII NAUK GRUZINSKOY SSR: SERIYA KHIMICHESKAYA in Russian Vol 15 No 3, Jul-Aug-Sep 89 (manuscript received 7 Jan 88) pp 167-170

[Article by F. I. Brouchek, M. M. Kariauli, M. Sh. Bibilashvili, A. L. Gozalov, and Ts. T. Sharabidze, Georgian Polytechnic Institute]

[Abstract] A study was made of the sorption processes in the system copper (II) ions - hydrogen peroxide - EDTA-modified anionite, where the domestic-grade anionites AV-16 and AV-17 served as the anionite. Dynamic sorption capacity served as a criterion of sorption effectiveness. Experiments were conducted under dynamic conditions in chromatographic columns 1.6 cm in diameter and 9.0 cm in height. The results show that the AV-17 anionite exceeds the AV-16 with respect to sorption capacity in all cases, and this makes it suitable for increasing the concentration of dilute copper (II) ion solutions. The method appears promising for use with other metals. References 6 (Russian).

**Direct Determination of Cesium in Cadmium-Mercury-Tellurium Alloys by Laser-Stimulated Flame Ionization**

18410265B Moscow VYSOKOCHISTYYE VESHCHESTVA in Russian No 4 Jul-Aug 89 (Manuscript received 10 Jun 88) pp 186-90

[Article by S. V. Bachin, A. G. Marunkov, I. I. Vlasov, V. I. Pavlutsкая, and N. V. Chekalin, Institute of Geochemistry and Analytic Chemistry imeni V. I. Vernadskiy, USSR Academy of Sciences, Moscow]

[Abstract] A two-stage system for excitation of cesium with a strong permitted 6p-level shift in the first stage is employed in analysis for the first time; it provides a limit of detection (when a propane-butane-air flame is used) of 0.1 pg/ml in aqueous solutions and allows the determination of traces of cesium in CdHgTe alloys at the level of  $10^{-8}$  mass percent. Two methods are used to introduce the solution into the flame: pneumatic atomization and evaporation from a heated graphite surface. A calibration curve is generated in the range of 1 pg through 10  $\mu$ g/ml. The cesium signal is not suppressed up to a weight relationship of alloy to element of  $10^{10}/1$ . The results show that the atomic-ionization method of analysis in

both flame and rod-flame modifications can be successfully used for direct determination of cesium in the alloy studied at the  $10^{-8}$  percent level with good reproducibility and speed. Figures 3; References 5: 3 Russian, 2 Western.

UDC 543.272.6:546.28

**Vacuum-Extraction Determination of Carbon in Semiconductor Silicon**

18410265D Moscow VYSOKOCHISTYYE VESHCHESTVA in Russian No 4, Jul-Aug 89 (Manuscript received 28 Dec 88) pp 204-09

[Article by K. V. Komdakova, Yu. A. Karpov, K. Yu. Natanson, Deceased, P. N. Petrov, G. I. Aleksandrova, and G. G. Sikharulidze, State Scientific Research and Planning Institute of the Rare Metals Industry, Moscow]

[Abstract] An attempt is made to experimentally estimate the sorption of carbon monoxide by Fe-Ni-Si-O sublimates formed in the process of determination of carbon in silicon by oxidative fusion in a vacuum. It is found that sorption of carbon monoxide by the sublimates does occur at the analysis temperature of 1,450 °C, or in the case of a cold crucible when the metal is not heated, carbon monoxide sorption is slight. To eliminate the influence of residual gases on absorption, residual gas pressure must not exceed  $10^{-10}$ - $10^{-11}$  torr. Figures 2; References 23: 15 Russian, 8 Western.

UDC 539.2:669.23

**Monitoring Platinum Metal Quality by Relative Residual Resistance**

18410265G Moscow VYSOKOCHISTYYE VESHCHESTVA in Russian No 4, Jul-Aug 89 (Manuscript received 29 Feb 88) pp 240-43

[Article by A. G. Libinson, M. A. Kravsov, and A. M. Orlov, State Scientific Research and Planning Institute of the Rare Metals Industry, Moscow]

[Abstract] The relative residual resistance, i.e., the ratio of the resistance of a metal at room temperature and 0 K, is widely used to estimate the purity of metals. This article discusses the application of this method to platinum. Ranges of the content of soluble impurities within which the method is reliable are estimated. The possible masking effect of such defects as dislocations, vacancies, and grain boundaries is also discussed. The ratio of resistances measured at room temperature and 4.2 K can be used to monitor the content of soluble impurities in platinum at not over  $10^{-2}$ - $10^{-5}$  at. percent. Figure 1; References 14: 11 Russian, 3 Western.

UDC 547.26'118

**Lawesson Reagent in Organophosphorus  
Synthesis. III. Conversion of Dialkylphosphorous  
Acids to Dialkylthiophosphorous Acids and  
Dialkylchlorothiophosphates**

*18410278D Leningrad ZHURNAL OBSHCHEY  
KHIMII in Russian Vol 59 No 7, Jul 89 (Manuscript  
received 17 Dec 87), pp 1493-1500*

[Article by M. G. Zabiroy, R. A. Cherkasov, I. S.  
Khalikov, A. N. Pudovik, Kazan State University imeni  
V. I. Ulyanov-Lenin]

[Abstract] Previous studies on the conversion of dialkylphosphorous and phosphonous acids to dialkylthiophosphorous and thiophosphonous acids by the action of the Lawesson reagent (2,4-bis(4-methoxyphenyl)-1,3,4,2-dithiadiphosphetane-2,4-disulfide) are expanded to include more dialkylphosphorous acids. The reactions lead to dialkylthiophosphorous and thiophosphonous acids easily and with high yield. When exposed in sequence to the Lawesson reagent and sulfur chloride, dialkylphosphorous acids are converted easily and with high yield to dialkylchlorothiophosphates. The reverse sequence of the addition of the reagents leads to significantly lower yields of dialkylchlorothiophosphates. References 19: 5 Russian, 14 Western.



UDC 678.4.09.34:665.735

**Resistance of Nonmetallic Materials to Gasolines With Synthetic Components***18410271D Moscow KHIMIYA I TEKHNLOGIYA TOPLIV I MASEL in Russian No 8, Aug 89 pp 29-31*

[Article by S. R. Lebedev, S. V. Levinin, and G. I. Shtanko]

[Abstract] Some synthetic oxygen-containing gasoline additives are harmful for rubber and other materials used in motor vehicle fuel handling systems. This article studies the endurance of nonmetallic materials used in these systems for fuel storage and transportation when exposed to gasolines containing various additives. It is recommended that not over 5 percent methanol and ethanol be used in gasoline that will contact nonmetallic materials. Synthetic oxygen-containing components of all types can be used in fuel systems that are based on type SKF-26 fluorene- containing raw rubber and polyethylene. References 2: 1 Russian, 1 Western.

UDC 665.637.7

**Intensification of Production of Paraffins With Surface-Active Agents***18410271B Moscow KHIMIYA I TEKHNLOGIYA TOPLIV I MASEL in Russian No 8, Aug 89 pp 12-14*

[Article by A. A. Gundyrev, L. P. Kazakova, T. I. Sochevko, and M. D. Pakhomov, Moscow Institute of Oil and Gas imeni I. M. Gubkin]

[Abstract] A study was made of the influence of modifiers used in the deparaffinization of 420-500 °C petroleum fractions from mixtures of Western Siberian oil on

the vacuum distillation of crude paraffin with subsequent oil removal of the fraction boiling up to 470 °C. It was found that introduction of the modifier to the raw material before deparaffinization and oil removal is not desirable since it increases the content of aromatic hydrocarbons and resins, causing reduced quality. The optimal version is the use of a modifier in the stage of deparaffinization. References 4: Russian.

UDC [66.097.3:546.621]+542.934

**Decomposition and Removal of Aluminum Chloride Catalyst by Water in Production of Polybutenes***18410271C Moscow KHIMIYA I TEKHNLOGIYA TOPLIV I MASEL in Russian No 8, Aug 89 pp 20-21*

[Article by S. V. Kotov, V. N. Filin, K. V. Prokofyev, and M. D. Cherupkova, Kuybyshev Affiliate, All-Union Scientific Research Institute of Oil Refining]

[Abstract] A process of water washing of the polymerisate from production of polybutenes without the use of alkali was studied as a means of decreasing the large volume of wash water used to remove the  $AlCl_3$  catalyst from the product. Water washing was performed for 0.5-1 hr at 20-70 °C, the water content in the system was 10-15 percent by volume, and the pH of the water was 6-7. Water washing of the polymerisate with subsequent passage through a layer of adsorbent was found to increase the quality of the end product while avoiding the use of alkali to remove the catalyst. The quantity of aluminum-containing wastewater in this stage of the process is decreased by a factor of 20-25. Figures 2; References 3: Russian.

UDC 543.544

**Study of Diffusion Processes in Polymeric Sorbents by Gas Chromatography**

18410241B Tbilisi IZVESTIYA AKADEMII NAUK GRUZINSKOY SSR: SERIYA KHIMICHESKAYA in Russian Vol 15 No 3, Jul-Aug-Sep 89 (manuscript received 29 Feb 88) pp 196-200

[Article by T. G. Andronikashvili, I. Gradil, F. Shvets, N. D. Kakriashvili, and N. M. Gogitidze, Physical Organic Chemistry Institute imeni P. G. Melikishvili; Macromolecular Chemistry Institute, Prague]

[Abstract] When chromatographic analyses are conducted under ideal conditions, the components of the mixture eluted through the chromatographic column should be recorded as narrow and symmetrical peaks over definite intervals of time. This time interval varies only with the nature of the interaction between the substance analyzed and the adsorbent. In some cases when porous polymeric sorbents are used as packing in the chromatographic column, the recorded peaks are elongated and asymmetrical. The shape of the chromatographic curve then depends on various factors, one of

them being the slow diffusion of the molecules into the pores of the sorbent. Under certain conditions the Van Demeeter formula makes it possible to calculate the coefficient of slow (Knudsen) diffusion into the pores of the sorbent from the relationship of the width of the chromatographic peak to the carrier gas throughput rate. In the present work a study was made of the diffusion of  $C_5$ - $C_{11}$  n- hydrocarbons, aromatic hydrocarbons, ethers, and  $C_1$ -  $C_3$  monohydric aliphatic alcohols into the pores of the cation-substituted macroporous sulfocationite G-60-91-Sp synthesized from glycidyl dimethacrylate and ethylenedimethacrylate. The results show that the diffusion coefficient is inversely proportional to the size of the molecule. This agrees well with the Einstein equation correlating the diffusion coefficient with the length of the molecular chain. The coefficient of diffusion is directly proportional to temperature of the column. Maximum diffusion coefficient values were obtained at a carrier gas throughput velocity of 50 ml/min. This also coincides with the minimum on the Van Demeeter curve. The results also indicate that gas chromatography may be successfully used to determine diffusion coefficients in sorbent-sorbate systems with proper selection of factors. Figure 1; references 5: 3 Russian, 2 Western.

UDC 541.14:546.791.6

**Effect of Spectral Composition of Light on Photostimulation of Uranyl Oxygen Exchange***18410242C Leningrad RADIOKHIMIYA in Russian  
Vol 31 No 2, Mar-Apr 89 (manuscript received  
21 Jan 88, after revision 27 Jun 88 pp 48-52*

[Article by S. A. Gaziyeu, L. G. Mashirov, and D. N. Suglovov]

[Abstract] It was established previously that uranyl-water oxygen exchange is the result of a reaction catalyzed by the uranyl ion, which rapidly exchanges oxygen with hydroxonium ions and propagates oxygen exchange as a result of its own electron interchange with the uranyl ion. The high coefficient of propagation and the possibility of a cumulative effect without disrupting chemical equilibrium makes oxygen exchange a highly informative means of studying the photochemistry of uranyl since the activity of the uranyl ion, as a photosensitizer of chemical reactions, is based upon the oxidation of various inorganic and organic reagents and takes place primarily through the formation of  $UO_2^+$ . An important characteristic of a photosensitizer is the photochemical activity of its individual levels of excitation, and in the case of uranyl this has not yet been studied. In the present work a study was made of the quantum yield of oxygen exchange of uranyl as a function of the wavelength of light for the case of a perchlorate solution of uranyl perchlorate and this same solution containing  $Cl^-$  and ethanol for the purpose of obtaining information on the roles of various electron states of the excited uranyl in reactions with electron A donors. It was concluded that both water and the  $Cl^-$  ion could be oxidized with uranyl excited to the level of the upper component of the  $T_1$  triplet. The oxidizing capability of photosensitized uranyl, as determined by the position of the  $T_1$  level, could also be a function of the crystalline field of the central ion. Figures 3; references 24: 6 Russian, 18 Western.

UDC 546.296.16:546.296.21

**Study of Radon Oxide Stability in Aqueous Solution***18410242F Leningrad RADIOKHIMIYA in Russian  
Vol 31 No 2, Mar-Apr 89 (manuscript received  
11 Apr 88) pp 124-127*

[Article by V. V. Avrorin, R. N. Krasikova, V. D. Nefedov, and M. A. Toropova]

[Abstract] Radon oxide was first prepared by hydrolysis of the fluoridation products of radon in the presence of NaF as a fluoride ion donor and  $BrF_3$  solvent. To study the properties of this new chemical form of radon it is first necessary to determine its state in the hydrolysate (ion-molecular or pseudocolloidal). Centrifuging the solution for 1.5 to 5 hours at 274 K and acceleration to 300,000 g did not reveal any noticeable change in radon concentration or any concentration gradient, and this suggests that

radon exists in either the ionic or molecular form but not in the colloidal form. Initial studies of its properties showed that radon oxide decomposes at 273 K into elemental radon. Under acid conditions (pH = 2), the reaction rate constant increases linearly with the concentration of sodium fluoride. However, attempts to obtain fluoride ion-free solutions were not successful. The fluoride ion concentration may be lowered 30- to 40-fold by suppressing the dissociation of sodium fluoride by adding an electrolyte that dissociates readily but that is indifferent to radon, such as sodium perchlorate. Kinetic studies showed that the compound most probably exists as  $RnO^3$ . Figures 2; references 6: 5 Russian, 1 Western.

UDC 621.039.327:546.744.3

**Leaching Neptunium From Tributyl Phosphate Solutions in Presence of Dibutylphosphoric Acid***18410243D Leningrad RADIOKHIMIYA in Russian  
Vol 31 No 3, May-Jun 89 (manuscript received  
26 Oct 88) pp 69-72*

[Article by S. I. Rovnyy and L. V. Goncharuk]

[Abstract] During the extraction refining of spent nuclear fuel, various radiation chemical conversions take place within the two-phase system that lead to the formation and accumulation of extractant destruction products, chiefly mono- and di-n- butylphosphoric acids. According to existing data, the presence of more than  $10^{-5}$  mol/l dibutylphosphoric acid in the organic phase results in detectable retention of uranium, plutonium, and zirconium during acid washing of the extractant. The behavior of neptunium under these conditions has not yet been studied sufficiently. In the present work a study was made of the distribution of neptunium during re-extraction from an organic solution containing 30 percent tributyl phosphate and solvent consisting of n-paraffins and  $CCl_4$ . Regardless of the type of solvent used, the presence of tributyl phosphate in the organic phase results in lowering the efficiency of the re-extraction due to neptunium retention in the organic phase as a dibutylphosphate complex. Saturation of the organic phase with uranium increases the efficiency as a result of the competitive capability of uranyl nitrate to form the dibutylphosphate complex. The efficiencies of a number of re-extraction solutions were checked for leaching neptunium from the organic phase containing dibutylphosphoric acid, and the high efficiency of alkali-peroxide and carbonate solutions was demonstrated. Figures 2; references 7: 4 Russian, 3 Western.

UDC 621.039

**Extraction of  $Am^{(III)}$  From Nitric Acid With Mixtures of Neutral Organophosphorus Reagents***18410243E Leningrad RADIOKHIMIYA in Russian  
Vol 31 No 3, May-Jun 89 (manuscript received  
3 May 88) pp 73-81*

[Article by M. K. Chmutova, G. A. Priblylova, N. P. Nesterova, B. F. Myasoyedov, and M. I. Kabachnik]

[Abstract] The previously demonstrated possibility of using dialkyl[dialkylcarbamoylmethyl]phosphonates and dialkyl[(diaryl)dialkylcarbamoylmethyl]phosphine oxides for the extraction leaching and concentration of transplutonium elements from nuclear fuel waste has stimulated further study of 20 of these compounds. While many are useful for the above purpose, they also have certain drawbacks such as the formation of insoluble complexes with metals; also, both the complexes and the reagents themselves are practically insoluble in aliphatic solvents. One way to circumvent these shortcomings is through the addition of neutral monofunctional tributyl phosphates, which are compatible with most solvents. It has been demonstrated that using

mixtures of tributyl phosphate with the above reagents increases the solubility of the latter and the metal complexes in organic solvents. In the present work a study was made of the extraction of  $\text{Am}^{(III)}$  with mixtures of tributyl phosphate and the above organophosphorus reagents from nitric acid and how it is effected by changes in component concentration and the nature of the reagent and solvent. A nonadditive change in the coefficient of distribution of americium was observed during the addition of tributyl phosphate to the organophosphorus solution, the magnitude of the change depending on the nature of the reagent and solvent. Figures 7; references 12: 7 Russian, 5 Western.

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